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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR MULTIMETER IS-189 (SIMPSON MODEL 260) AND SIMPSON MODELS 260 SERIES II, III, 4, and 5 AND 270

Headquarters, Department of the Army, Washington, D.C.
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SECTION I

IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification

This bulletin provides instructions for the A- and C-level calibration of Multimeter IS-189 (Simpson Model 260) and Simpson Models 260 Series II, III, 4, and 5 and 270. The manufacturer's instruction manual was used as the prime data source in compiling these instructions. The multimeter will be referred to as the "TI" (test instrument) throughout this bulletin.

a. Model Variations. Variations among models are described in text.

b. Time and Technique. The time required for this calibration is approximately 4 hours, using the dc and low frequency technique.

2. Calibration Data Card (DA Form 2416)

Maintenance forms, records, and reports which are to be used by calibration personnel at all calibration levels are listed in and prescribed by TM 38-750.

3. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to Publications, and forwarded direct to Commander, U. S. Army Missile Command, ATTN: AMSMI-MFPA, Redstone Arsenal, AL 35809.

4. Calibration Description

TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Direct current: Model 260 and Model 260 Series II Model 260 Series III, 4, and 5, and Model 270	 0 to 10 amperes in 5 ranges 0 to 10 amperes in 6 ranges
Dc voltage: Model 260 and Model 260 Series II Model 260 Series III, 4, and 5, and Model 270	 0 to 5000 volts in 6 ranges 0 to 5000 volts in 7 ranges
Ac voltage	0 to 5000 volts in 6 ranges
Dc resistance	0 to 20 megohms in 3 ranges

Test Instrument.	Current Ranges Percent of Full Scale.		Ac Voltage Ranges Percent of Full Scale.		Dc Voltages Ranges Percent of Full Scale.		Resistance Scales.	
	50 μa.	All other ranges.	5000 v.	All other ranges.	5000 v.	All other ranges.	Rx 1	All other ranges.
Models 260 and 260 series II.	N/A	±3%	±5%	±5%	±3%	±3%	±3° arc.	±3° arc.
Model 260 series III.	±3%	±3%	±3%	±3%	±3%	±3%	±3° arc.	±3° arc.
Model 260 series 4.	±2%	±2%	±3%	±3%	±2%	±2%	±3° arc.	±3° arc.
Model 260 series 5.	±1.5%	±2%	±4%	±3%	±3%	±2%	±2.5° arc.	±2° arc.
Model 270	±2%	±2%	±4%	±3%	±3%	±2%	±2° arc.	±2° arc.

SECTION II
EQUIPMENT REQUIRED

5. Equipment Required

Table 2 identifies the specific equipment used in this calibration procedure. This equipment is issued with secondary transfer calibration standards set 4931-621-7877 and Maintenance Calibration Standard Set, AN/TSM-55, and is to be used in performing this procedure. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one accuracy ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

6. Accessories Required

The accessories listed in table 3 are issued with secondary transfer calibration standards set 4931-621-7877 and are to be used in this calibration procedure. When necessary, these items may be substituted by equivalent items unless specifically prohibited. Accessories should be used as necessary for C-level calibration.

Table 2. Minimum Specifications of Equipment Required

Item	Common Name	Minimum Use Specifications.	Manufacturer, Model, and Part Number.
A1	AC/DC VOLTMETER.	Range: 17 to 103 mvdc 4750 to 5250 vac. Accuracy: [1]	Dana, Model 5703-S-2127 (7912606).
A2	POWER SUPPLY.	Range: 0 to 10.3 amps	New Jersey Engineering, Model CS36CR30 (7907346-2).
A3	HIGH-VOLTAGE POWER SUPPLY.	Range: 4850 to 5150 vdc Accuracy: ±0.5%	John Fluke, Model 410B (MIS-10230).
A4	DECADE RESISTOR.	Range: 40 to 400,000 ohms	Winslow, Model 336 (7907234).
A5	RESISTANCE STANDARD.	Range: 10.5 to 137,000 ohms Accuracy: ±0.75%	Biddle-Gray, Model 601147-1 (7910328). John Fluke, Model 760A.[2]
A6	CURRENT SHUNT.	Range: 0.0001 to 10 amps Accuracy: [1]	Guildline, Model 9711 (7912323). John Fluke, Model 760A.[2]
A7	AC VOLTAGE SOURCE.	Range: 2.375 to 990 vac at 60 and 400 Hz. Accuracy: ±0.75%	Hewlett-Packard, Models 745A-C90 (MIS-10342) 746A-C90 (4931-017-4737) John Fluke, Model 760A.[2]

[1] See footnote at end of table.

Table 2. Minimum Specifications of Equipment Required - Continued

Item	Common Name	Minimum Use Specifications.	Manufacturer, Model, and Part Number.
A8	DC VOLTAGE STANDARD.	Range: 2.425 to 1030 vdc Accuracy: ± 0.5%	John Fluke, Model 332A (7911393). John Fluke, Model 760A [2]
A9	TRANSFORMER	Output: at least 5250 vac	Fisher Engineering, Model TP 1290 (MIS-10275).

[1] Combined accuracy of A1 and A6: ± 0.5%.

[2] C-level standards.

Table 3. Accessories Required

Item	Common Name	Description and Part Number
B1	ADAPTER BOX	High-voltage isolation box. (SKD 4850-3)
B2	LEAD [1]	24-in., with single banana plug terminations (red) (7907497).
B3	LEAD	24-in., with single banana plug terminations (black) (7907498).

[1] Two required.

SECTION III
CALIBRATION PROCESS

7. Preliminary Instructions

a. The instructions outlined in this section are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

c. Set TI in horizontal position.

NOTE

Remove TI from protective case only to make adjustments.

d. Adjust mechanical zero-adjustment screw for zero meter indication.

WARNING

HIGH VOLTAGE is used during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met before continuing with the calibration.

8. Direct Current

a. Performance Check

NOTE

When TI is model 260 series III, 4, or 5 or model 270 perform steps (1) and (3) through (10) below. When TI is model 260 or model 260 series II, perform steps (2) and (4) through (10) below.

(1) Model 260 series III, 4, or 5 or model 270:

(*a*) Connect equipment as shown in connection A of figure 1.

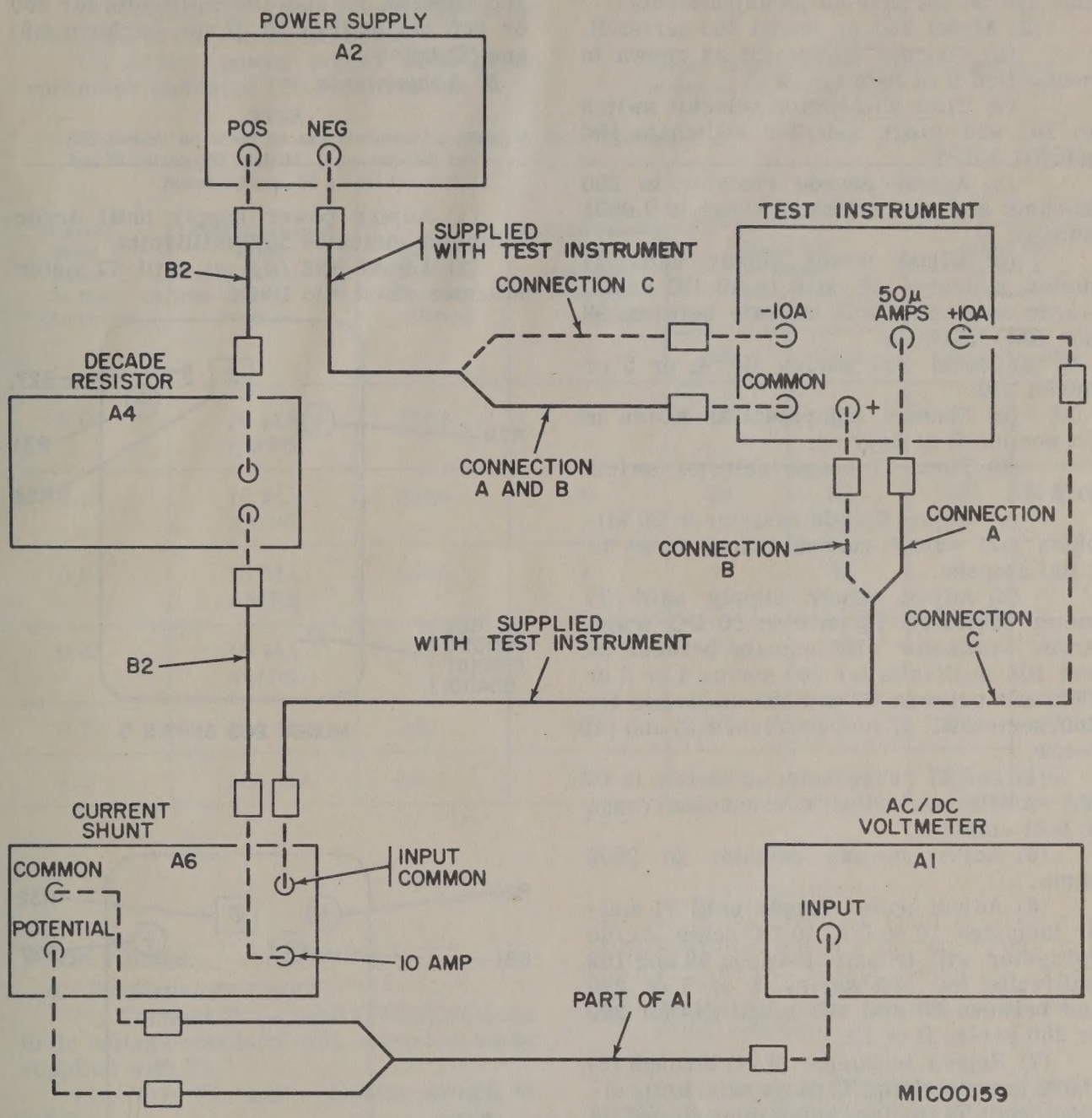


Figure 1. Direct current - equipment setup.

(*b*) Turn TI function selector switch to +DC and range selector switch to 50V μAMPS.

(*c*) Adjust decade resistor (A4) to 400 kilohms.

(*d*) Adjust current shunt (A6) range to 0.0001 ampere.

(*e*) Adjust power supply (A2) until TI meter indicates 10 on 0 to 10 DC scale. Ac/dc voltmeter (A1) will indicate between 49.25 and 50.75 millivolts for 260 series 5, between 49 and 51 millivolts for 260 series 4 or 270, and between 48.5 and 51.5 millivolts for 260 series III. If 260 series 4 and

5 are not within limits specified, perform *b*(1) and (2) below. Models 260 series III and 270 do not have 50-μa adjustments.

(2) Model 260 or model 260 series II:

(*a*) Connect equipment as shown in connection B of figure 1.

(*b*) Turn TI function selector switch to DC and range selector switch to 100 MICRO AMPS.

(*c*) Adjust decade resistor to 200 kilohms and current shunt range to 0.0001 ampere.

(*d*) Adjust power supply until TI meter indicates 10 on 0 to 10 DC scale. Ac/dc voltmeter will indicate between 97 and 103 millivolts.

(3) Model 260 series III, 4, or 5 or model 270:

(*a*) Connect equipment as shown in connection B of figure 1.

(*b*) Turn TI range selector switch to 1 MA.

(*c*) Adjust decade resistor to 20 kilohms and adjust current shunt range to 0.001 ampere.

(*d*) Adjust power supply until TI meter indicates 10 on 0 to 10 DC scale. Ac/dc voltmeter will indicate between 98 and 102 millivolts for 260 series 4 or 5 or 270, and between 97 and 103 millivolts for 260 series III. If not, perform *b*(3) and (4) below.

(4) Set TI range selector switch to 10 MA.-AMPS., and adjust current shunt range to 0.01 ampere.

(5) Adjust decade resistor to 2000 ohms.

(6) Adjust power supply until TI meter indicates 10 on 0 to 10 DC scale. Ac/dc voltmeter will indicate between 98 and 102 millivolts for 260 series 4 or 5 or 270 and between 97 and 103 millivolts for 260 or 260 series II or III.

(7) Repeat technique of (4) through (6) above for remaining TI range selector positions and TI meter indications listed in table 4. Ac/dc voltmeter will indicate within limits specified.

(8) Connect equipment as shown in connection C of figure 1. Remove decade resistor from equipment setup.

(9) Turn TI range selector switch to 10 MA.-AMPS. and adjust current shunt range to 10 amperes.

(10) Adjust power supply until TI meter indicates 10 on 0 to 10 DC scale. Ac/dc voltmeter will indicate between 98 and 102 millivolts for 260 series 4 or 5 or 270, and between 97 and 103 millivolts for 260 or 260 series II or III. If not, perform *b*(5) and (6) below.

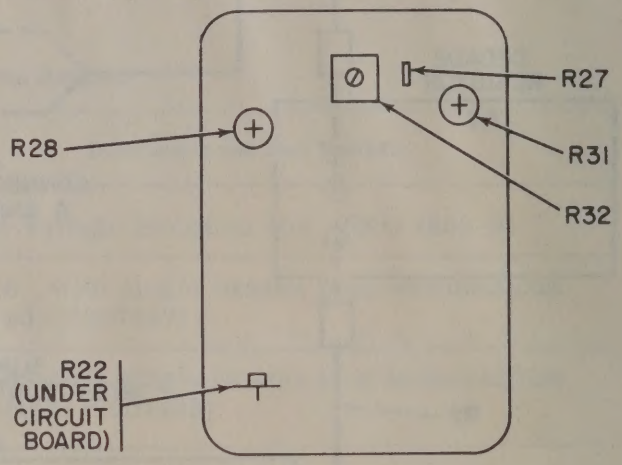
b. Adjustments

NOTE

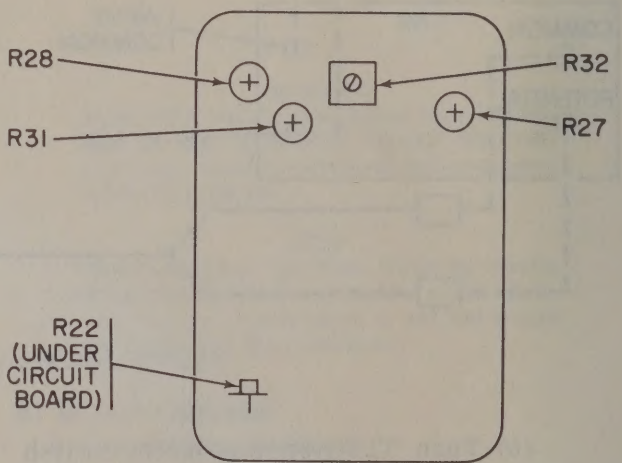
No adjustments can be made on models 260 and 260 series II. Models 260 series III and 270 do not have a 50-μa adjustment.

(1) Adjust power supply until ac/dc voltmeter indicates 50.0 millivolts.

(2) Adjust R32 (fig. 2) until TI meter indicates 10 on 0 to 10 DC scale.



MODEL 260 SERIES 5



MODEL 270, 260 SERIES 4
AND 260 SERIES III

MIC00160

Figure 2. Multimeter - interior view.

(3) Adjust power supply until ac/dc voltmeter indicates 100.0 millivolts.

(4) Adjust R27 (fig. 2) until TI meter indicates 10 on 0 to 10 DC Scale.

(5) Adjust power supply until ac/dc voltmeter indicates 100.0 millivolts.

(6) Adjust R22 (fig. 2) for TI meter indication of 10 on 0 to 10 DC scale.

NOTE
It may be necessary to remove circuit board to gain access to R22.

Table 4. Direct Current

Current Shunt Range Setting (Amperes).	Test Instrument Range Selector Switch Position.	Decade Resistor Setting (Ohms).	Test Instrument Meter Indication (0 to 10) DC Scale).	Ac/Dc Voltmeter Indications (mvdc).			
				Model 260 or Model 260 Series II or III.		Model 260 Series 4 or 5 or Model 270.	
				Min	Max	Min	Max
0.01	10 MA. AMPS.	2500	8	77	83	78	82
0.01	10 MA. AMPS.	3300	6	57	63	58	62
0.01	10 MA. AMPS.	5000	4	37	43	38	42
0.01	10 MA. AMPS.	10000	2	17	23	18	22
0.1	100 MA.	200	10	97	103	98	102
1.0	500 MA.	40	10	48.5	51.5	49	51

9. Dc Voltage

a. Performance Check

(1) Connect TI (+) and COMMON jacks to dc voltage standard (A8), using test leads supplied with TI.

(2) Turn TI range selector switch to 2.5 V.

(3) Adjust dc voltage standard until TI meter indicates 10 on 0 to 10 DC scale. Dc voltage standard will indicate between 2.45 and 2.55 volts for 260 series 4 or 5 or 270, and between 2.425 and 2.575 volts for 260 and 260 series II or III.

(4) Repeat technique of (2) and (3) above for TI range selector switch positions listed in table 5. Dc voltage standard will indicate within limits specified.

NOTE
Do not perform the remaining checks for C-level calibration.

(5) Connect TI DC 5000 V and COMMON jack to high-voltage power supply (A3), using TI test leads, high-voltage power supply leads, and adapter box (B1).

(6) Adjust high-voltage power supply until TI meter indicates 10 on 0 to 10 DC scale. High-voltage power supply will indicate between 4900 and 5100 volts for 260 series 4, and between 4850 and 5150 volts for 260, 260 series II, III, and 5, and 270.

b. Adjustments. No adjustments can be made.

Table 5. Dc Voltage

Test Instrument		Dc Voltage Standard Indication (vdc).			
Range Selector Switch.	Meter Indications (0 to 10 DC Scale).	Model 260 or Model 260 Series II or III.		Model 260 Series 4 or 5 or Model 270.	
		Min	Max	Min	Max
2.5 V [1]	10	2.425	2.575	2.45	2.55
10 V	10	9.7	10.3	9.8	10.2
50 V	10	48.5	51.5	49	51
250 V	10	242.5	257.5	245	255
1000 V	10	970	1030	980	1020

[1] Notes below not applicable to models 260 and 260 series II:
a. Turn TI function selector switch to -DC.
b. Reverse connections to dc voltage standard.
c. Following the measurement, set TI function selector switch to +DC, and reverse connection to dc voltage standard.

10. Ac Voltage

a. Performance Check

(1) Connect equipment as shown in figure 3.

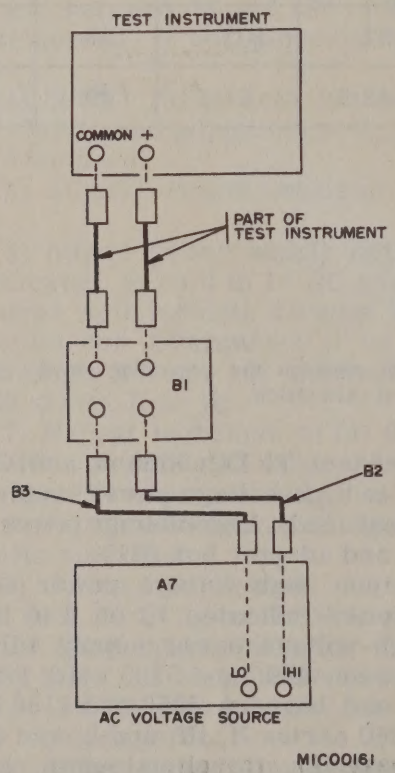


Figure 3. Ac voltage - equipment setup.

(2) Turn TI function selector switch to AC and range selector switch to 2.5 V.

(3) Adjust frequency of ac voltage source (A7) to 60 Hz, and adjust amplitude output until TI meter indicates 2.5 on 0 to 2.5 AC scale. Ac voltage source will indicate between 2.425 and 2.575 volts for 260 series III, 4, or 5 or 270, and between 2.375 and 2.625 for 260 and 260 series II. If not, perform *b* below.

(4) Repeat technique of (2) and (3) above for TI range selector switch positions listed in table 6. Ac voltage source will indicate within limits specified. If not, perform *b* below.

NOTE

Do not perform the remaining checks for C-level calibration.

(5) Connect equipment as shown in figure 4.

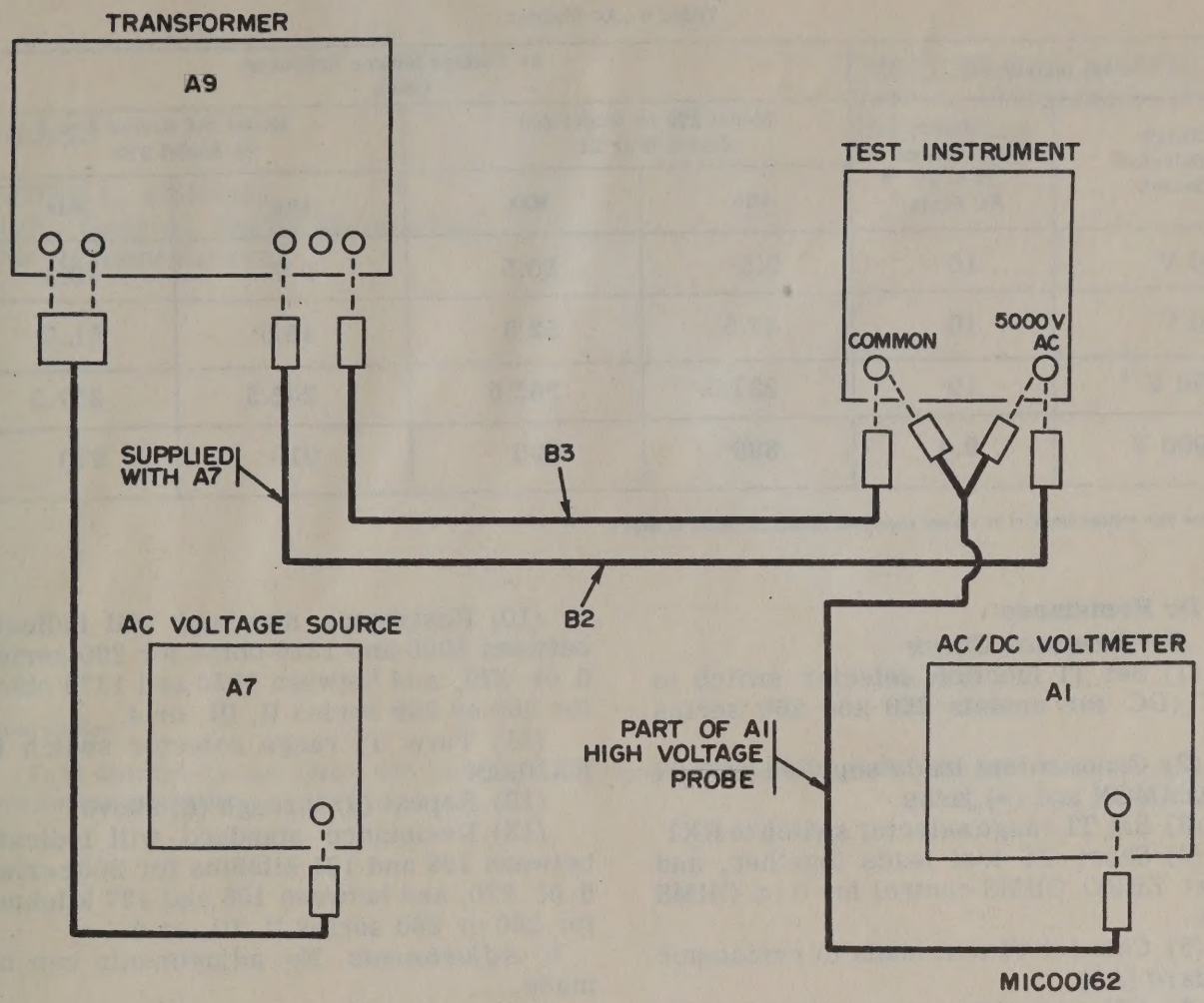


Figure 4. High voltage - equipment setup.

(6) Adjust ac voltage source frequency to 400 Hz and output until TI meter indicates 50 on 0 to 50 AC scale. Ac/dc voltmeter (A1) will indicate between 4850 and 5150 volts for 260 series III or 4, between 4800 and 5200 volts for 260 series 5 or 270, and between 4750 and 5250 volts for 260 or 260 series II.

b. Adjustments

NOTE

No adjustments can be made for models 260 and 260 series II.

(1) Turn TI range selector switch to 250 V.

(2) Adjust ac voltage source for 250.0 volts.

(3) Adjust R31 (fig. 2) until TI meter indicates 2.5 on 0 to 2.5 AC scale.

(4) Turn TI range selector switch to 2.5 V.

(5) Adjust ac voltage source for 2.50 volts.

(6) Adjust R28 (fig. 2) until TI meter indicates 2.5 on 0 to 2.5 AC scale.

(7) Repeat (1) through (6) above until no further adjustments are required.

Table 6. Ac Voltage

Test Instrument		Ac Voltage Source Indication (vac).			
Range Selector Switch.	Meter Indications (0 to 10 AC Scale).	Model 260 or Model 260 Series II or III.		Model 260 Series 4 or 5 or Model 270.	
		Min	Max	Min	Max
10 V	10	9.5	10.5	9.7	10.3
50 V	10	47.5	52.5	48.5	51.5
250 V [1]	10	237.5	262.5	242.5	257.5
1000 V	9.4	890	990	910	970

[1] Use high voltage output of ac voltage source for remaining checks in table 6.

11. Dc Resistance

a. Performance Check

(1) Set TI function selector switch to +DC (DC for models 260 and 260 series II).

(2) Connect test leads supplied with TI to COMMON and (+) jacks.

(3) Set TI range selector switch to RX1.

(4) Short TI test leads together, and adjust ZERO OHMS control for 0 on OHMS scale.

(5) Connect TI test leads to resistance standard (A5).

(6) Adjust resistance standard until TI meter indicates 12 on OHMS scale.

(7) Resistance standard will indicate between 10.5 and 13.7 ohms for 260 or 260 series II, III, or 4, between 10.7 and 13.5 ohms for 260 series 5, and between 10.9 and 13.1 ohms for 270.

(8) Turn TI range selector switch to RX100.

(9) Repeat (4) through (6) above.

(10) Resistance standard will indicate between 1090 and 1310 ohms for 260 series 5 or 270, and between 1050 and 1370 ohms for 260 or 260 series II, III, or 4.

(11) Turn TI range selector switch to RX10,000.

(12) Repeat (4) through (6) above.

(13) Resistance standard will indicate between 109 and 131 kilohms for 260 series 5 or 270, and between 105 and 137 kilohms for 260 or 260 series II, III, or 4.

b. Adjustments. No adjustments can be made.

12. Final Procedure

a. Deenergize and disconnect all equipment.

b. In accordance with TM 38-750, annotate and affix DA Label 80 (U.S. Army Calibration System). When the TI cannot be adjusted within tolerance, annotate and affix DA Form 2417 (Unserviceable or Limited Use tag).

By Order of the Secretary of the Army:

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